

1. Work requester fills out this section.

☐ Standing Work Permit

Requester: Don Lynch	Date: 03/08/2012	Ext.: 2253	Dept/Div/Group: PO/PHENIX
Other Contact person (if different from requester): Carter Biggs			Ext.: 7515
Work Control Coordinator: Don Lynch		Start Date: 03/12/2012	Est. End Date: 03/15/2012
Brief Description of Work: Trouble shoot FVTX and VTX thermal and coolant leak problems			
Building: 1008	Room: IR	Equipment: VTX/FVTX	Service Provider: PHENIX techs

WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis

**ES&H ANALYSIS**

<b>Radiation Concerns</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Activation	<input type="checkbox"/> Airborne	<input type="checkbox"/> Contamination	<input checked="" type="checkbox"/> Radiation
Radiation Generating Devices:	<input type="checkbox"/> Radiography	<input type="checkbox"/> Moisture Density Gauges	<input type="checkbox"/> Soil Density Gauges	<input type="checkbox"/> X-ray Equipment	
<input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group			<input type="checkbox"/> Fissionable materials involved, notify Laboratory Criticality Officer		
<b>Safety Concerns</b>	<input type="checkbox"/> None	<input type="checkbox"/> Ergonomics	<input type="checkbox"/> Transport of Haz/Rad Material		
<input type="checkbox"/> Adding/Removing Walls or Roofs	<input type="checkbox"/> Confined Space*	<input type="checkbox"/> Explosives	<input type="checkbox"/> Lead*	<input type="checkbox"/> Penetrating Fire Walls	
	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Flammable	<input type="checkbox"/> Magnetic Field*	<input type="checkbox"/> Pressurized Systems	
<input type="checkbox"/> Asbestos*	<input type="checkbox"/> Cryogenic	<input type="checkbox"/> Fumes/Mist/Dust*	<input type="checkbox"/> Material Handling	<input type="checkbox"/> Rigging/Critical Lift	
<input type="checkbox"/> Beryllium*	<input type="checkbox"/> Electrical	<input type="checkbox"/> Heat/Cold Stress	<input type="checkbox"/> Noise*	<input type="checkbox"/> Toxic Materials*	
<input type="checkbox"/> Biohazard*	<input checked="" type="checkbox"/> Elevated Work*	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Non-ionizing Radiation*	<input type="checkbox"/> Vacuum	
<input type="checkbox"/> Chemicals*	<input type="checkbox"/> Excavation	<input type="checkbox"/> Lasers*	<input type="checkbox"/> Oxygen Deficiency*	<input type="checkbox"/> Other	

\* Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? ☐ Yes ☒ No

<b>Environmental Concerns</b>	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Work impacts Environmental Permit No.	
<input type="checkbox"/> Atmospheric Discharges (rad/non-rad)	<input type="checkbox"/> Land Use	<input type="checkbox"/> Soil Activation/contamination	<input type="checkbox"/> Waste-Mixed
<input type="checkbox"/> Chemical or Rad Material Storage or Use	<input type="checkbox"/> Liquid Discharges	<input type="checkbox"/> Waste-Clean	<input type="checkbox"/> Waste-Radioactive
<input type="checkbox"/> Cesspools (UIC)	<input type="checkbox"/> Oil/PCB Management	<input type="checkbox"/> Waste-Hazardous	<input type="checkbox"/> Waste-Regulated Medical
<input type="checkbox"/> High water/power consumption	<input type="checkbox"/> Spill potential	<input type="checkbox"/> Waste-Industrial	<input type="checkbox"/> Underground Duct/Piping
Waste disposition by:	<input type="checkbox"/> Other		

**Pollution Prevention (P2)/Waste Minimization Opportunity:** ☒ None ☐ Yes

<b>FACILITY CONCERNS</b>	<input checked="" type="checkbox"/> None
<input type="checkbox"/> Access/Egress Limitations	<input type="checkbox"/> Electrical Noise
	<input type="checkbox"/> Impacts Facility Use Agreement
<input type="checkbox"/> Configuration Control	<input type="checkbox"/> Potential to Cause a False Alarm
<input type="checkbox"/> Maintenance Work on Ventilation Systems	<input type="checkbox"/> Temperature Change
<input type="checkbox"/> Utility Interruptions	<input type="checkbox"/> Vibrations
<input type="checkbox"/> Other	

**WORK CONTROLS**

<b>Work Practices</b>				
<input type="checkbox"/> None	<input type="checkbox"/> Exhaust Ventilation	<input checked="" type="checkbox"/> Lockout/Tagout	<input type="checkbox"/> Spill Containment	<input type="checkbox"/> Security (see Instruction Sheet)
<input checked="" type="checkbox"/> Back-up Person/Watch	<input type="checkbox"/> HP Coverage	<input type="checkbox"/> Posting/Warning Signs	<input type="checkbox"/> Time Limitation	<input type="checkbox"/> Other
<input type="checkbox"/> Barricades	<input type="checkbox"/> IH Survey	<input type="checkbox"/> Scaffolding-requires inspection	<input type="checkbox"/> Warning Alarm (i.e. "high level")	

**Protective Equipment**

<input type="checkbox"/> None	<input type="checkbox"/> Ear Plugs	<input type="checkbox"/> Gloves	<input type="checkbox"/> Lab Coat	<input checked="" type="checkbox"/> Safety Glasses
<input type="checkbox"/> Coveralls	<input type="checkbox"/> Ear Muffs	<input type="checkbox"/> Goggles	<input type="checkbox"/> Respirator	<input type="checkbox"/> Safety Harness
<input type="checkbox"/> Disposable Clothing	<input type="checkbox"/> Face Shield	<input type="checkbox"/> Hard Hat	<input type="checkbox"/> Shoe Covers	<input checked="" type="checkbox"/> Safety Shoes
<input type="checkbox"/> Other				

**Permits Required** (Permits must be valid when job is scheduled.)

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Cutting/Welding	<input type="checkbox"/> Impair Fire Protection Systems
<input type="checkbox"/> Concrete/Masonry Penetration	<input type="checkbox"/> Digging/Core Drilling	<input type="checkbox"/> Rad Work Permit-RWP No
<input type="checkbox"/> Confined Space Entry	<input type="checkbox"/> Electrical Working Hot	<input type="checkbox"/> Other

**Dosimetry/Monitoring**

<input type="checkbox"/> None	<input type="checkbox"/> Heat Stress Monitor	<input type="checkbox"/> Real Time Monitor	<input type="checkbox"/> TLD
<input type="checkbox"/> Air Effluent	<input type="checkbox"/> Noise Survey/Dosimeter	<input type="checkbox"/> Self-reading Pencil Dosimeter	<input type="checkbox"/> Waste Characterization
<input type="checkbox"/> Ground Water	<input type="checkbox"/> O <sub>2</sub> /Combustible Gas	<input type="checkbox"/> Self-reading Digital Dosimeter	<input type="checkbox"/> Other Check O <sub>2</sub> level prior to entry
<input type="checkbox"/> Liquid Effluent	<input type="checkbox"/> Passive Vapor Monitor	<input type="checkbox"/> Sorbent Tube/Filter Pump	

**Training Requirements** (List below specific training requirements)

CA -Collider User, PHENIX Awareness, Working at heights

Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below:			If using the permit when all hazard ratings are low, only the following need to sign: ( Although allowed, there is no need to use back of form)	
<b>ES&amp;H Risk Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	WCC: _____ Date: _____
<b>Complexity Level:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	Service Provider: _____ Date: _____
<b>Work Coordination:</b>	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Moderate	<input type="checkbox"/> High	Authorization to start _____ Date: _____
(Departmental Sup/WCC/Designee)				

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

See attached work plan				
Special Working Conditions Required: None				
Operational Limits Imposed: Modification work limited to lower octants easily reachable when standing on lower magnet superstructure.				
Post Work Testing Required: No				
Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Walkdown Required: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
<b>Reviewed by:</b> Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements.				
<b>Title</b>	<b>Name (print)</b>	<b>Signature</b>	<b>Life #</b>	<b>Date</b>
Primary Reviewer				
ES&H Professional				
Other				
Other				
Work Control Coordinator	Don Lynch		20146	
Service Provider				
		Review Done: <input type="checkbox"/> in series <input type="checkbox"/> team		

4. Job site personnel fill out this section.

Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments).			
Job Supervisor:		Contractor Supervisor:	
Workers:	Life#:	Workers :	Life#:
Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below.			

5. Departmental Job Supervisor, Work Control Coordinator/Designee

Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.)			
Name:	Signature:	Life#:	Date:

6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required. ☐ Yes ☐ No

Post Job Review (Fill in names of reviewers)			
Name:	Signature:	Life#:	Date:
Name:	Signature:	Life#:	Date:

7. Worker provides feedback.

Worker Feedback (use attached sheets as necessary)	
a) WCM/WCC: Is any feedback required? <input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Workers: Are there better methods or safer ways to perform this job in the future? <input type="checkbox"/> Yes <input type="checkbox"/> No	

8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)

Name:	Signature:	Life#:	Date:
Comments:			

**FVTX & VTX Trouble Shooting**

**Introduction**

This procedure is prepared to document the steps necessary to make minor changes to the VTX/FVTX coolant flow distribution, trouble shooting to isolate and repair a internal small coolant leak, trouble shoot thermal problems and add 4 aluminum chill plates to the exterior of the FVTX/VTX assemblies, 1 each on the north and south end of the east and west detector halves. (Note: the chill plates may not be installed pending results of the troubleshooting efforts).

The tasks described above are worker planned work and do not require a specific procedure, except the following procedure to prepare the FVTX/VTX subsystem for warm up prior to separating the detector halves.

**Procedure**

**NOTE: all work is to be performed only by appropriately trained PHENIX technicians.**

A) The following is the procedure to be followed to warm up the system.

- 1) At ~6 AM confirm with the Shift Crew that the VTX/FVTX systems are off.
- 2) Once confirmed, set chiller 1 to 5C (chiller one is on the left closest to the shield wall. It is labeled). It is currently set to 0C (or lower). It should be left there for an hour to warm up on its own.
- 3) An hour later (~7am), the set-point of chiller 1 should be set to 10C.
- 4) At ~8am, the plug door will open and access to the CM central region will be provided by moving the EC and/or WC.
- 5) Before the FVTX/VTX halves can be separated, the temp of the system should be confirmed to be at 10C.
- 6) Once detector is ready to be separated, the chiller set-points should be set to 20C. Once this is done, the power to the chillers (both 1 and 2) should be turned OFF. This will drop the pressure in the system to zero. Changing the set-point to 20C before turning off is done so that when the chillers are powered back on, the compressors do not try to cool the fluid right away.

B) Carefully separate the 2 halves to their open position ~ 10 inches from the beampipe, taking care to avoid any contact with detector surfaces. This is worker planned work to be performed only by PHENIX technicians approved by PHENIX engineering.

At this point PHENIX technicians and FVTX/VTX experts shall perform the tasks described above, taking care to minimize the time that the halves are separated and installing covers when possible. After all tasks have been acceptably completed proceed to the next step.

C) Remove the covers and carefully close the 2 halves to their run position tightly around the beampipe, taking care to avoid any contact with detector surfaces and to completely seal the detector. This is worker

planned work to be performed only by PHENIX technicians approved by PHENIX engineering.

D) Once the halves are together and we are ready to flow Novec, the follow steps should be followed to turn the cooling system back ON:

- 1) Put the system into Bypass. To do this, open the bypass valve first, then close the feed and return valves slowly.
- 2) Once in bypass, turn the chiller back on and note the temp of both systems. Set the set-point of the chillers to that temperature this way we are only circulating fluid and not cooling it.

*The next step is to pressurize the detector and look for any new leaks that may have developed. There are 4 loops in the cooling system:*

*VTX/FVTX North, VTX/FVTX South, Big Wheel North, Big Wheel South.  
(note, the VTX pixels are on the Big Wheel loops)*

- 3) To test a loop, open one of the feed valves slowly to pressurize one of the manifolds. Note, the bypass valves should still be open. Check the manifold for leaks. At the same time, carefully look at the detector for leaks. If that loop is fine, open both the feed valve and return valve completely then close the bypass valve slowly.

4-6) Repeat step3 for the other 3 loops.

- 7) Once all 4 loops are running, recheck the connections for leaks since the systems pressure will double once all the bypass valves are closed.

**Please note, the detector should be closed and flowing N2 for at least an hour before bringing chiller 1 temp below 10C.**

- 8) Once all loops are pressurized and tested, the system can commence cooling. The set-points of the chillers can be dropped by ~5C per hour until chiller 1 is at 0C and Chiller 2 is at 10C.

- 9) Once at operating temps, the manifolds and detector should be checked for leaks again in case something happened during the temperature cycle. The connections inside of chiller 1 and chiller 2 should also be inspected to make sure no leaks have developed again.

- 10) Final step is to make note in the chiller log book of the levels of the Novec so that losses can be monitored overnight.

After completing the above, note any difficulties or “lessons learned” on the work permit accompanying this procedure and close out this work permit.

